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SAMPLING AND ANALYSIS PLAN - VOLUME II
QUALITY ASSURANCE PROJECT PLAN

FOR THE
GULFCO MARINE MAINTENANCE
SUPERFUND SITE
FREEPORT, TEXAS

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1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) named the former site of Gulfco Marine Maintenance, Inc. in Freeport, Brazoria County, Texas (the Site) to the National Priorities List (NPL) in May 2003. The EPA issued a modified Unilateral Administrative Order (UAO), effective July 29, 2005, requiring Respondents to conduct a Remedial Investigation and Feasibility Study (RI/FS) for the Site. This Quality Assurance Project Plan (QAPP) was prepared as Volume II of a Sampling and Analysis Plan (SAP) in accordance with Paragraph 27.b of the Statement of Work (SOW) for the RI/FS included as an Attachment to the UAO. The QAPP was prepared by Pastor, Behling & Wheeler, LLC (PBW), on behalf of LDL Coastal Limited LP (LDL), Chromalloy American Corporation (Chromalloy) and The Dow Chemical Company (Dow) (collectively referred to as Respondents in the UAO).

The QAPP format and elements have been developed in accordance with guidance developed by the United States Environmental Protection Agency (EPA, 2001; EPA, 2002). The plan presents the policies, organization, objectives, functional activities, and other specific Quality Assurance/Quality Control (QA/QC) activities designed to achieve the precision, accuracy, completeness, comparability, and representativeness required to make the data quality acceptable for the RI/FS. A general description of RI/FS activities is provided in the RI/FS Work Plan (PBW, 2005b). Specific sampling locations and procedures are described in Volume I of the SAP, the Field Sampling Plan (FSP) (PBW, 2005c).

2.0 PROJECT MANAGEMENT

2.1 PROJECT ORGANIZATION

The general project organization is presented in Figure 1. This chart shows the primary members of the project management team, and lists the current site contractors. Roles and responsibilities for the Project Coordinator and other team members are described in the RI/FS WP. The responsibilities of the persons assigned to QA/QC activities are listed below.

2.1.1 Respondents' Project Coordinator

The Respondents' Project Coordinator will provide the principal point of contact and control for matters concerning the project and field investigation implementation. In consultation with the Respondents, the Project Coordinator will:

- Coordinate field investigation activities and develop a detailed schedule;
- Establish project policies and procedures to meet the specific objectives of the project;
- Orient all field staff concerning the project;
- Develop and meet ongoing project staffing requirements, including mechanisms to review and evaluate each work product;
- Review the work performed on each project to help ensure its quality, responsiveness and timeliness; and
- Represent the project team at meetings and public hearings, if necessary.

The Project Coordinator is responsible for implementation of the QA program in conformance with this QAPP. Final responsibility for project quality rests with the Project Coordinator.

2.1.2 Remedial Investigation Manager

The RI Manager will direct and supervise all RI work. The RI Manager's responsibilities will be to review all RI project work to ensure that it meets the specific project goals, meets technical standards, and is in accordance with the objectives and procedures discussed herein.

2.1.3 Quality Assurance Manager

The Quality Assurance Manager (QA Manager) will remain independent of direct involvement in day-to-day operations, but will have direct access to staff, as necessary, to resolve any QA issues. The QA Manager has sufficient authority to stop work on the investigation as deemed necessary in the event of serious QA/QC issues. Specific functions and duties include:

- Performing QA audits on various phases of the project's operations, as necessary;
- Reviewing and approving this QAPP and other QA plans and procedures;
- Performing validation of data collected relative to RI/FS activities and this QAPP; and
- Providing QA technical assistance to project staff.

The QA Manager will notify the Project Coordinator of particular circumstances that may adversely affect the quality of data and ensure implementation of corrective actions needed to resolve nonconformances noted during assessments.

2.1.4 Field Supervisor

The Field Supervisor will be responsible for all aspects of field work performed as part of a specific RI/FS activity. Different project subtasks or activities may have different Field Supervisors. Duties of the Field Supervisor will include:

- Maintaining field records;
- Continually surveying the Site for potential work hazards and relate any new information to site personnel at the Tailgate Safety Meeting held each day prior to beginning field activities.
- Ensuring that field personnel are properly trained, equipped, and familiar with Standard Operating Procedures and the Health and Safety Plan;
- Overseeing sample collection, handling and shipping; ensuring proper functioning of field equipment; and
- Informing the laboratory when samples are shipped to the lab and verifying samples arrived at the lab.

The primary duty of the Field Supervisor is to ensure that the field sampling is performed in accordance with the project sampling plans and this QAPP. The Field Supervisor will also require that appropriate personal protective equipment will be worn and disposed of according to the Health and Safety Plan (PBW, 2005a). In addition, the Field Supervisor may be responsible for preparing monitoring reports for review by the Project Manager.

2.1.5 Analytical Lab Project Manager

The Analytical Laboratory Project Manager will work directly with the Field Supervisor and QA Manager and will be responsible for the following:

- Ensuring all necessary laboratory resources are available to meet project schedules;
- Shipping sample containers and preservatives to the field samplers;

- Overseeing production and final review of analytical reports;
- Coordinating laboratory analyses;
- Supervising in-house chain of custody (COC);
- Scheduling sample analyses;
- Overseeing laboratory data review;
- Approving final analytical reports prior to submission;
- Overseeing laboratory QA;
- Overseeing QA/QC documentation;
- Defining appropriate laboratory QA procedures; and
- Determining whether to implement laboratory corrective actions, as required.

2.2 PROBLEM DEFINITION/BACKGROUND

As described in the RI/FS WP, the overall problem to be addressed by the RI/FS is to evaluate the nature and extent of contamination at and from the Site, assess the risk from this contamination to human health and the environment, and evaluate potential remedial alternatives. Consistent with this overall problem, the specific objectives of this RI/FS are to: (1) characterize site conditions; (2) evaluate the nature and extent of the contamination; (3) assess the risks to human health and the environment; (4) identify remedial action objectives for those chemicals and media posing an unacceptable risk; (5) develop preliminary remediation goals (PRGs) to address the remedial action objectives; (6) develop, screen and evaluate potential remedial technologies consistent with the PRGs; (7) examine the potential performance and cost of the remedial alternatives that are being considered; and (8) select the appropriate alternative for site remediation.

The technical approach for meeting these objectives is described in detail in the RI/FS WP, and includes the following overarching components:

- Use of existing data from previous site investigations;
- Incorporation of TRIAD Approach elements, including systematic project planning, dynamic work strategies; and real-time measurement technologies;
- Focus on potential receptors and an evaluation of the risks associated with the potential exposure pathways identified in the Conceptual Site Model (CSM) through a receptor-based investigation program;
- Consideration of Site end use objectives in terms of land use/zoning, and potential site development issues, particularly to the extent that the Site remedy supports and may even augment Site development plans; and
- Recognition of potential contributions from natural processes to Site remediation.

2.3 PROJECT/TASK DESCRIPTION

This QAPP has been developed to address the activities described in the RI/FS WP and in the FSP. Protocols that will be followed for sample handling and storage, chain of custody, laboratory analyses, reporting, data validation, and corrective actions are described in this QAPP, or will be added to the QAPP as they become necessary. The information contained in this QAPP is intended for use in conjunction with the sampling methods and procedures described in detail in the FSP.

The goal of the QAPP is to assure that the data collected meet the project objectives established in Section 2.4. All QA/QC procedures will be in accordance with applicable professional standards, government regulations and guidelines, and specific project goals and requirements.

Samples will be submitted to the analytical laboratory for analysis. Sample data will first be verified by reviewing field documentation and chain-of-custody records. The

laboratory will internally verify the data by reviewing documentation of sample receipt, sample preparation, sample analysis, laboratory QC samples, data reduction and data reporting. Data verification and validation will then be conducted in accordance with the procedures presented in Section 5.0 of this QAPP.

Consistent with the TRIAD approach, should any field analytical methods, including field screening methods for evaluating the presence of non-aqueous phase liquids (NAPL), be employed, a Demonstration of Method Applicability (DMA) will be prepared and submitted to EPA for review and approval.

2.4 PROJECT OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data quality objectives (DQOs) are qualitative and quantitative statements derived from the outputs of each step of the DQO process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity and quality of environmental data used in decision-making are appropriate for the intended application (EPA, 2000a).

There are seven steps in the DQO process which are:

1) Stating the problem;
2) Identifying the decision;
3) Identifying inputs to the decision;
4) Defining the boundaries of the study;
5) Developing a decision rule;
6) Specifying limits on decision errors; and
7) Optimizing the design for obtaining data.

The problem, as stated in Section 2.2 of this QAPP, is to: a) evaluate the nature and extent of contamination at and from the Site and also assess the risk from this

contamination to human health and the environment; b) provide sufficient site data necessary to evaluate remedial technologies; and c) evaluate alternatives for addressing the risk to human health and the environment from the contamination at and from the Site. This problem statement is consistent across all types of data needs.

In accordance with the above seven step process, DQOs were developed by media for the CSM exposure routes and associated data needs identified in Table 13 of the RI/FS WP as follows:

- Table 1 – Soils/Sediment;
- Table 2 – Groundwater;
- Table 3 – Surface Water; and
- Table 4 – Fish Tissue.

In addition, geotechnical investigation DQOs are provided in Table 5.

Based on the DQOs, the project analytical objectives for each media can be summarized as presented in Table 6. All measurements must be made so that results are of sufficient quality (i.e., technical validity and legal defensibility) to support the project objectives. As such, all data collected should meet the following criteria:

- Sampling – Samples will be collected using approved standard operating procedures.

- Documentation – Sample custody will be documented to maintain security and show control during transfer of samples from collection through disposal.

- Laboratory – The analytical laboratory will have a documented quality system which complies with ANSI/ASQC E-4 1994, “Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs,” (American National Standard, January 5, 1995) and “EPA Requirements for Quality Management Plans (QA/R-2)” (EPA/240/B-01/002, March 2001). This requirement is considered met by laboratories accredited under the National Environmental Laboratory Accreditations Program (NELAP).

- Analysis – Data must be definitive (i.e., generated using rigorous analytical methods such as an EPA-approved method, ASTM standard method, or laboratory method that is formally documented and demonstrated to be applicable).

- Quality Control (QC) – Measurement performance criteria for both field and laboratory QC must be based on the intended use and should be a function of sampling design, requirements in the analytical methods, and standard accepted practice.

- Sensitivity – For data that will be used in quantitative risk assessment, the Method Detection Limit (MDL) should be less than the Preliminary Screening Values (PSV) as defined in the RI/FS WP. If it is not possible to achieve an MDL below the PSV, then the standard available method with the lowest possible MDL shall be used for that analyte. The laboratory should routinely check the MDLs for reasonableness and update them as necessary.

2.4.1 Analytical Methodologies

Appropriate analytical methodologies have been selected based on the criteria presented in Section 2.4 and presented for each media in Appendices A through E. Additionally, Appendices A through E summarize the method requirements for sample preservation and holding time.

2.4.2 Data Quality Indicators/Performance Criteria

Performance goals have been established based on the criteria presented in Section 2.4 for each of the Data Quality Indicators (Precision, Accuracy, Completeness, Representativeness, and Comparability) as defined below.

2.4.2.1 Precision

Precision is a measure of the reproducibility between two or more measurements of the same characteristic (i.e., analyte, parameter) under the same or similar conditions. Determining the agreement among replicate measurements of the same sample assesses the precision of the analytical procedure; combined precision of sampling and analysis procedures is assessed from the agreement between measurements of field duplicate samples. The relative percent difference (RPD) in the results will be computed for each duplicate pair using the equation provided in Section 3.6.

Field Precision Objectives

Precision of sampling and analysis procedures will be assessed through the collection of field duplicate samples at the frequencies listed in Appendices A through E for the specific media. The goals for precision of field duplicate results are also listed in the appendices. Data for duplicate analyses will be evaluated only if both of the samples in the duplicate pair have a concentration greater than the method quantitation limit (MQL). It is noted here that natural variation in some of the matrices will affect how closely these goals are met; that is, if variation is high, then these goals are unrealistic. Consequently, RPD results from field duplicates will not be used as a basis for invalidating any analytical data.

Laboratory Precision Objectives

Precision of the analytical procedure will be assessed through duplicate analyses of laboratory QC and field samples. Data for duplicate analyses will be evaluated only if both of the samples in the duplicate pair have a concentration greater than the method quantitation limit (MQL). The precision goals for laboratory duplicates for each media/analyte are listed in Appendices A though E.

2.4.2.2 Accuracy

Accuracy is a measure of the bias in terms of the degree of agreement between an observed value (i.e., sample result) and the accepted reference or true value. Accuracy is expressed as the percent recovery of spiked analytes. The equations used to calculate percent recovery are included in Section 3.6.

Laboratory blank samples and field blanks will also be used to quantify the effect of sample contamination on overall data accuracy.

Field Accuracy Objectives

The potential for field contamination will be assessed through collection of equipment blanks (when non-dedicated sampling equipment is used) and trip blanks (for VOC samples) and adherence to all sample handling, preservation and holding time requirements. The objectives for minimizing the effect of field contamination on sample accuracy are listed for each media in Appendices A through E.

Laboratory Accuracy Objectives

Laboratory accuracy will be evaluated by the analysis of laboratory control samples (LCS), matrix spike (MS) samples and surrogate spikes (SU), with results expressed as a percentage recovery measured relative to the true (known) concentration. Laboratory LCS, MS/MSD, and SU recovery goals are provided in Appendices A through E for each media. In addition, laboratory preparation blank results will be used to measure any contamination introduced during the analytical process. The objectives for minimizing the effect of laboratory contamination on sample accuracy are concentrations less than the MQL in all blank samples.

2.4.2.3 Completeness

Completeness is the percentage of valid measurements or data points obtained, as a proportion of the number of measurements or data points planned for the project. Completeness is affected by such factors as sample bottle breakage and acceptance/rejection of analytical results. Completeness will be re-calculated and presented in each validation checklist. If completeness approaches the established goal (within 2-3%), corrective action will be instituted as described in Section 4.0. The completeness goal on a sample level is 90% and the goal on an analyte level is 80%.

2.4.2.4 Representativeness

Representativeness is a qualitative objective, defined as the degree to which data accurately and precisely represent the characteristic of a population, the parameter variations at a sampling point, the process condition, or an environmental condition within a defined spatial and/or temporal boundary.

Field Representativeness Objectives

Field representativeness is achieved by collecting a sufficient number of unbiased (representative) samples and implementing a QC program for sample collection and handling prior to analyses. The sampling approaches developed for this project will provide for samples that are representative of site conditions. Any equipment blank and field blank results will also be evaluated to ensure that analytical results are representative of sample concentrations.

Laboratory Representativeness Objectives

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate sample handling and preparation methods, meeting sample holding times and analyzing and assessing duplicate samples.

2.4.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another.

Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the standard field protocols in the FSP are consistently followed and that the sampling techniques specified in the sampling plan are consistently used.

Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when the sampling and analytical methods described in the FSP and in this QAPP are used for sample collection and laboratory analysis. This goal is achieved through the consistent use of standard techniques to collect and analyze representative samples. Results of sample analyses will be consistently reported in appropriate units. Comparability is also dependent upon the laboratory obtaining the QA objectives for accuracy and precision. All data that meet the QA objectives described in this document and are considered usable will be considered comparable data.

2.5 QUALITY OBJECTIVES AND CRITERIA FOR HISTORICAL DATA

For secondary data (data that were previously collected for a different intended use), acceptance criteria are used in place of measurement performance criteria. Historical data that have been obtained using standard sampling techniques, custody documentation, and definitive analytical procedures and that have been previously validated and not rejected for serious QC deficiencies are considered acceptable for nature and extent and quantitative risk assessment purposes. These previously

validated existing data will be reviewed prior to use to ensure consistency (particularly in terms of data flag usage and reporting format such as units, reporting limits, etc.), with data validation procedures for data obtained during the RI/FS.

Historical data that have not been previously validated and that will be used for nature and extent or risk assessment purposes will be validated in accordance with the procedures described in Section 5.0. Historical data that have not been obtained using standard sampling techniques, custody documentation, and definitive analytical procedures may only be used qualitatively.

2.6 SPECIAL TRAINING/CERTIFICATION

All field personnel who will collect samples addressed by this QAPP will have received 40 hour OSHA Hazardous Waste Site Operations training with annual 8-hour refreshers and medical monitoring. All personnel shall also have received 24 hours of supervised field training. The Field Project Supervisor shall have completed an additional 8-Hour OSHA Supervisor training course. The Site Safety Officer shall hold a current certificate for first aid/CPR training. Other training may be instituted as required. The RI Manager will be responsible for assuring that all required training is obtained and for maintaining all records documenting the required training.

2.7 DOCUMENTS AND RECORDS

The Respondents' Project Coordinator will distribute the QAPP to the persons listed on the distribution list on page vii of the QAPP. The Project Coordinator will be responsible for ensuring that all addenda are provided to the persons on this list, such that they will have the most current approved version of the QAPP. Updates to the QAPP will be controlled through use of a revision header on each page. This header will note the date of the revision and the revision letter (D for draft and F for final) followed by a revision number.

The FSP will also be distributed as indicated on this list. All QA audit reports, progress reports, corrective action reports and validation checklists will be maintained by the Project Coordinator with a copy retained by the QA Manager. Other project documents will be managed as described below.

2.7.1 Field Operation Records

Field operation records include sample collection records, chains of custody (COCs), custody seals, QC sample records, field procedures, and corrective action reports. Field sampling activities are documented on field data sheets. At each site, station IDs, location, sampling time, date, and sample collector's name/signature are recorded. The type of sample collected from each location will be recorded and serve as a check to assure that all intended samples are collected. If a field or lab QA/QC sample is to be collected at a site for a specific sample, this information will be documented on the field data sheets.

Values for all measured field parameters will be recorded. Observational data will be recorded, for instance water appearance, weather, biological activity in the sample, unusual odors, and other sample specific information.

COCs will be filled out for all samples collected and include the information documented in Section 3.3 below.

Any problems or comments related to a specific sample will also be documented on the field data sheet. Such information would include moving a station location, if analytical samples require composites to be generated from more than one sample or if there were any circumstances at a site that prevented a sample from being collected.

Any corrective actions necessary to insure that sample integrity is maintained will be documented. If field standard operating procedures (SOPs) are violated or deviations are made, a corrective action report will be documented indicating what occurred,

actions taken to correct the failure, as well as the effect of the action on the sample in question.

2.7.2 Laboratory Records

Laboratory records will include all of the data in the data reporting package (described in a later section. In addition to the items in the data reporting package, at a minimum, the following records will be maintained by the laboratory:

- Sample preparation log books;
- Standard solutions preparation log books;
- Temperature records for storage units (standards, samples);
- Equipment calibration and maintenance records; and
- Certification records for standards.

2.7.3 Data Handling Records

Data generated as part of this project will be handled according to the data management steps outlined in Section 3.10, as well as the verification and validation procedures identified in Section 5.0 of this document.

2.7.4 Laboratory Data Reporting Package Format/Documentation Control

The analytical laboratory will prepare Level IV data packages for all analyses. The data package will include the following reportable data:

- A signed narrative which includes a detailed discussion of non-conformity events, corrective measures, data deficiencies, sample dilutions required, any evidence of matrix interference, etc.
- Complete Chain-of-Custody Documentation;
- Laboratory Sample Receipt Forms;
- Sample Identification and QC Batch Cross-Reference Table;
- Test Reports for Samples;
- Surrogate Recovery Data;
- Test Reports for Laboratory Blank Samples;
- Summary Forms for Laboratory Control Samples (LCS);
- Summary Forms for Matrix Spike/Matrix Spike Duplicate (MS/MSD);
- Summary Forms for Laboratory Duplicates;
- Summary Forms for Internal Standards;
- Summary Forms for GC/MS Tuning;
- Summary Forms for Metals Interference Check Samples, Serial Dilutions and MSA;
- Summary Forms for GC Dual Column/Detector Confirmation;
- Summary Forms for Pesticide Breakdown;
- Instrument run logs, extraction logs, and digestion logs;
- Initial calibration data with summary report;
- Initial calibration verification (ICV) data with summary report;

- Continuing calibration verification (CCV) data with summary report;
- Initial calibration blank (ICB) data with summary report;
- Continuing calibration blank (CCB) data with summary report;
- Method detection limit documentation;
- DCS Documentation for reasonableness check of MDL; and
- Raw data (instrument printouts, chromatograms, mass spectra) for all samples, QC samples, and standards.

Test Reports shall include both the Method Detection Limit (MDL) and Method Quantitation Limit (MQL) adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and which take into account sample characteristics, sample preparation, and analytical adjustments. The MDL shall be determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B and should be routinely checked for reasonableness using the procedures for the Detectability Check Sample (DCS) as established by the Texas Commission on Environmental Quality (TCEQ). The Method Quantitation Limit shall correspond to the lowest non-zero concentration standard in the laboratory's initial calibration curve and is based on the final volume of extract (or sample) used by the laboratory. Non-detected results shall be reported as less than the value of the sample-specific MDL. Concentrations between the MDL and MQL shall be reported with a J-flag flag (or B-flag for inorganics) to indicate the concentration is an estimate. Aqueous results shall be reported in mg/L for inorganics and μg/L for organics. Soil and sediment data shall be reported in mg/kg for inorganics and μg/kg for organics and shall be corrected for dry-weight. . For GC analyses requiring secondary confirmation (i.e., Pesticides by SW-846 Method 8081 and PCB-Congeners by SW-846 Method 8082), the lower result shall be reported unless the relative percent difference (RPD) between the results exceeds the method criteria (40%) and there is no clear interference. The narrative should include a discussion of any disparity between results.

Summary Forms shall include the applicable QC parameter (i.e., RSD, recovery, RPD, etc.) for each analyte along with the true or reference amount, the measured amount,

and the laboratory control limits. The Laboratory Control Samples shall contain all target analytes for the analytical method as listed in Appendices A-E, which are routinely spiked by the laboratory. The Matrix Spike and Matrix Spike Duplicates (MS/MSDs) must be prepared using a sample from the Site

(as indicated on the Chain-of-Custody) and shall contain the same target analytes as the LCS at an appropriate level compared to the unspiked sample result.

Data reporting packages will be organized according to the analytical laboratory's sample data groups (SDGs). Data reporting packages will be prepared by the Analytical Lab Project Manager in both paper and electronic form. One paper copy and one electronic copy (on CD) of each data package will be submitted to the RI Manager. The electronic copy will be in portable document format (pdf) with all pages numbered sequentially. Data in Microsoft Excel or Microsoft Access will also be required in order to enter the data into a database. The pdf files will be read-only such that data items cannot be edited. Electronic copies will be provided on CD and by electronic mail.

2.7.5 Data Archiving and Retrieval

The documents that describe, specify, report, or certify activities, requirements, procedures, or results for the various activities and the items and materials that furnish objective evidence of the quality of items or activities are listed in Table 7. All field-collected data will be housed in its original format. Table 7 shows documents and record types, locations where these records will be housed, retention time and the form of the record. Laboratory data that are stored electronically will be archived electronically, and where printed as part of the paper data report package, will also be archived in paper form. In general, all records must be retained for a period of 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS, per Section XX, Paragraph 79 of the UAO.

3.0 DATA GENERATION AND ACQUISITION ELEMENTS

3.1 SAMPLING PROCESS DESIGN

Project sampling processes were designed to obtain information necessary to address those data needs associated with potentially complete or indeterminant exposure routes as described in the CSM, and identified during the RI/FS scoping process as described in the RI/FS WP. The DQOs in Tables 1-5 were developed for those identified potential exposure routes on a media-specific basis. As shown on Figure 10 of the RI/FS WP and detailed in the FSP, the sampling processes are iterative based on the data obtained and comparisons to Preliminary Screening Values (PSVs).

3.1.1 Scheduled Project Activities

Schedules for each sampling activity are shown on Figure 11 of the RI/FS WP.

3.1.2 Rationale for the Design

The overall rationale for the design of the RI/FS program is discussed in Section 4.0 of the RI/FS WP. Design rationale and objectives for specific tasks, including data generation subtasks, are provided by task in Section 5.0 of the RI/FS WP and are also evaluated by media in the DQOs. The rationale for the selection of specific sampling locations is included in the FSP. The proposed analytical suite for each sample is related to the Potential Source Area (PSA) associated with that sample, described in the RI/FS WP.

3.1.3 Design Assumptions

The design of the sampling program is based on the CSM, and the data needs resulting from an analysis of the CSM and the DQOs for the media to be sampled. Specific assumptions with regard to individual samples locations are provided in the FSP.

3.1.4 Sample Locations and Frequencies

Sample locations and sampling frequencies, including the type and total number of sample types/matrices and how samples sites will be identified, are specified in Section 3.0 of the FSP.

3.1.5 Critical and Non-Critical Samples

All chemical and physical samples collected are designated as critical samples. Sample integrity is of utmost concern for the activities covered by this QAPP, such that data gaps are not created in the record, and the end user requirements of the data are met.

3.1.6 Validation of Non-Standard Methods

All methods for sample collection are based on standard methods and accepted practices. Should any non-standard field analytical methods be proposed, a DMA will be prepared and submitted to EPA for review and approval prior to use.

3.2 SAMPLING METHODS

All sample methods are described in the FSP. SOPs for these methods are provided in Appendix A of the FSP.

3.2.1 Sample Volume, Containers, and Preservation

The sample volume, container and preservation requirements will be in accordance with requirements for the specific analytical methods. This information is provided in Appendices A through E for the specific activities covered by this QAPP.

3.2.2 Sampling/Measurement System Failure Response and Corrective Action Process

Failure of a sampling or measurement system shall be reported to the Field Supervisor and then to the RI Manager. The RI Manager is responsible for corrective actions, as described in Section 4.

3.3 FIELD SAMPLE HANDLING AND CUSTODY

3.3.1 Chain-of-Custody (COC)

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, analysis, and disposal.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is used to document sample handling during transfer from the field to the laboratory and among contractors. The list of items below should be included on the COC form.

- Site identification
- Sample identification
- Date and time of collection
- Sample matrix
- Container type

- Number of containers
- Preservative used
- Notation if the sample was filtered
- Analyses required
- Name and signature of collector(s)
- Custody transfer signatures and dates and time of transfer
- Name of laboratory admitting the samples
- Bill of lading (if applicable)

3.3.2 Sample Labeling

Sample labels are completed with an indelible, waterproof marker. Label information includes the sample identification number, the date and time of sampling and sample type. The sample identification numbering system for the project has been designed to uniquely identify each sampling station and sample according to the Site grid. This numbering system consists of grid column and row identification, sample media, a sequential sample location identifier, depth (if applicable), and QA/QC identifier (if applicable), as detailed in Section 4.0 of the FSP.

3.3.3 Sample Handling

Sample handling procedures for each activity and type of sample are described in the FSP.

3.3.4 Failures in Chain of Custody and Corrective Action

All failures associated with COC procedures are immediately reported to the person who originally signed the COC, typically the Field Supervisor. These include such items as

delays in transfer, resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The RI Manager or Field Supervisor, in consultation with the QA Manager will determine if the procedural violation may have compromised the validity of the resulting data. Any failures that have reasonable potential to compromise data quality will invalidate data, and the sampling event should be repeated. The resolution of the situation will be reported to the Project Coordinator. Corrective action reports will be maintained by the QA Manager.

3.4 LABORATORY SAMPLE HANDLING AND CUSTODY

3.4.1 Sample Receipt

Upon receipt by the laboratory, sample integrity will be inspected and documented on the COC or associated document (i.e., a sample receipt report or similar document). Information to be noted on the COC includes: name of person inspecting cooler, integrity of custody seals, sample cooler temperature, evidence of preservation, physical condition of sample container, and airbill number. The COCs will be reviewed for completeness. If any sample integrity or sample ID problems or discrepancies are found, the Field Supervisor or RI Manager will be notified immediately. A COC addendum or sample receipt report may be used to document the corrective actions used to address any COC discrepancies. If an addendum is not used, corrective actions used to correct COC discrepancies must be recorded directly on the COC. Samples will be stored in a specially designated area that is clean, dry, and refrigerated (if needed). After sample analysis, the unused portion of the sample and sample extracts/digestates, together with all identifying labels will be stored until written permission to destroy the samples is given by the RI Manager. Samples will be disposed of at treatment storage and disposal facilities (TSDFs) that are approved by Respondents. All sample labels will be rendered illegible prior to sample disposal.

3.4.2 Sample Labeling

The field sample number will be recorded on the sample inventory, the COC, and on the sample label. All samples will be assigned discrete sample identification numbers (sample control numbers) upon receipt by the laboratory. The laboratory sample control number will remain the same throughout the analysis and data entry procedures. Final results will be reported with both the field sample ID and the laboratory sample control number.

3.4.3 Sample Custody

The laboratory will be responsible for maintaining an accurate custody record for each sample in the lab. Records will be maintained to document the date and time the sample is checked out of sample storage for analysis and the date and time at which the sample is returned. The Laboratory Project Manager or laboratory contact will be responsible for supplying the Field Supervisor (or their designee) with a sample acknowledgment form within 24 hours of sample receipt. This form will provide sample receipt information, sample log-in information, and the laboratory project number for the samples. A completed, signed COC will be sent by the laboratory to the RI Manager with the final data report.

3.5 ANALYTICAL METHODS

Analytical methods are shown for each activity in Appendices A through E. Laboratory SOPs are provided in Appendix G. Performance-based measurement system (PBMS) methods may also be used as specified in Section 3.5.1.

The SW-846 methods contain inherent flexibility as described in Section 2.1 of Chapter 2 of SW-846. Where this flexibility is employed in this project, documentation shall be provided as described in Section 3.5.2. Consistent with the application of the TRIAD

approach during the RI/FS, a DMA will be prepared and submitted to EPA for review and approval prior to use of any field analytical methods.

3.5.1 Performance-Based Measurement System Methods

Performance-based measurement system (PBMS) methods are sample preparation and analytical methods that differ in some part of the procedures of the methods that are specified for this project in Appendices A through E. A PBM system is "a set of processes wherein the data quality needs, mandates or limitations of a program or project are specified, and serve as criteria for selecting appropriate methods to meet those needs in a cost-effective manner."[1] Examples of where PBMS methods may be used in this project are in overcoming matrix interference problems, lowering detection limits, and otherwise improving data quality to meet project DQOs.

If a laboratory uses PBMS methods, it should meet the QA/QC criteria recommended in the SW-846 manual. At a minimum, method performance should be supported by the QC components in Chapter 1 (Quality Control) of SW-846, including the QC information that should be
documented. Specifically, Section 4.3.4 (Test Methods) of Chapter 1 describes the minimum written documentation requirements for laboratory procedures. Section 4.4 (Laboratory QA and QC Procedures) of Chapter 1 describes the minimum QA/QC requirements for analytical procedures including proficiency (precision, bias and method detection limit), control procedures

and control limits (laboratory control samples, method blank, and matrix spikes), corrective action, and data handling.

Where PBMS methods are used in this project, documentation shall be provided as described in Section 3.5.2.

[1] OSWER PBMS Implementation Plan, A Cooperative Effort Among OSW, OERR, OUST, TIO, FFRRO, and CEPPO, October 9, 1998 (revision 1), page 3.

3.5.2 Documentation for Alternative Analytical Procedures

Where alternative analytical procedures, such as real-time field analytical methods, are used in this project, demonstration is required that they provide performance equivalent to the methods listed for this project in Appendices A through E. Alternative analytical procedures include those involving the inherent flexibility as allowed in SW-846 methods in Section 2.1 of Chapter 2 of SW-846 as well as those based on PBMS. Documentation of this demonstration will be in a DMA, which will include performance data as well as a detailed description of the procedures such as in an SOP.

3.5.3 Standards Traceability

All standards used in the laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book. Each document includes information concerning the standard identification, starting materials, including concentration, amount used and lot number, date prepared, expiration date and preparer's initials or signature. The reagent bottle is labeled in a way that traces the reagent back to the preparation.

3.5.4 Failures in Measurement Systems and Corrective Actions

In many cases, the field technician or lab analyst will be able to correct problems. If the problem is resolved by the field technician or lab analyst, he/she will document the problem on the field data sheet or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the Laboratory Project Manager, who will make the determination and notify the QA Manager. If the analytical system failures may compromise the sample results, the resulting

data will not be reported. The nature and disposition of the problem is reported on the data report, which is sent to the RI Manager.

3.6 QUALITY CONTROL

3.6.1 Sampling Quality Control Requirements and Acceptability Criteria

The minimum field QC requirements are outlined for each activity in Appendices A through E. Specific requirements are outlined below.

3.6.1.1 Field Duplicate

Field duplicates will be collected at the frequency given in Appendices A through E for each sampling activity covered by this QAPP, typically at the frequency of one per 20 field samples collected or at least one per sampling day. A field duplicate is defined as a second sample (or measurement) from the same location, collected in immediate succession, using identical techniques. The duplicate sample will be collected from the same homogenized composite material as the sample it is duplicating and will be submitted “blind” (i.e., without identifying it as a duplicate). Duplicate samples are sealed, handled, stored, shipped, and analyzed in the same manner as the primary sample. Precision of duplicate results is expressed as is calculated by the relative percent difference (RPD) calculated as defined by 100 times the absolute value of the difference (range) of each duplicate set, divided by the average value (mean) of the set:

3.6.1.2 Field Splits

Field splits are not required for any of the activities, but may be requested by the EPA. A field split is collected in the same manner as a field duplicate.

3.6.1.3 Equipment Blanks

Equipment blanks (rinsate) blanks will be collected at the frequency given in Appendices A through E for each sampling activity covered by this QAPP. When possible, rinsate blanks will be collected from the final rinse water of decontaminated equipment to assess the effectiveness of the cleaning and decontamination procedure.

3.6.1.4 Trip Blanks

Trip blanks will be collected at the frequency given in Appendices A through E for each sampling activity covered by this QAPP. Since trip blanks are used only when samples are collected for volatile organic compounds analyses, not all activities will require trip blanks.

3.6.2 Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Detailed laboratory QC requirements are contained within each individual method SOP in Appendix G. The minimum requirements for the QC samples are outlined below. Laboratory QC sample results are reported with the data report.

3.6.2.1 Laboratory Duplicates, Matrix Spikes, and Matrix Spike Duplicates

Duplicate analysis is performed as a measurement of precision on the analytical process. Laboratory duplicates are independently repeated measurements of the same sample, which are performed by the same analyst and under the same conditions. The sample is split in the laboratory and each fraction is carried through all stages of preparation and analysis. The calculation for relative percent difference (RPD) is performed from the two sample results. The equation for calculating RPD was provided in Section 3.6.1.1.

The duplicate procedure is performed at least once per 20 samples (5%). Control limit criteria are found in Appendices A through E for each media.

Matrix spike samples are prepared by adding a known amount of each target analyte (or a subset thereof) to a known amount of sample. The matrix spike is added at the beginning of the procedure and is carried through the entire measurement process. The sample itself (without a matrix spike) is also carried through the analytical process. In order to produce reliable recovery results, the spike level must be similar to the sample concentration. Because the matrix spike samples are prepared and analyzed at the same time as the sample, only a reasonable estimate of the spike level can be made. Where samples are collected in field areas that are expected to have high concentrations, they will be identified for the laboratory, and corresponding spike levels can be used. The amount of the spike should be at least four times the amount in the unspiked sample.

The spike recovery measures the effects of interferences caused by the sample matrix in the analytical process. The matrix spike recovery is calculated as follows:

The matrix spike procedure is performed once per batch of 20 samples. The matrix spike is performed twice and the second spike is called the matrix spike duplicate. This procedure evaluates the precision associated with the procedure and the analyst performing the procedure and is calculated as a RPD as described above.

The sample to be used for the MS/MSD shall be designated on the COC. The MS/MSD is used to document the bias of a method due to sample matrix, not to control the analytical process and thus laboratory corrective action is not instituted based on MS/MSD results. If completeness goals are not being met as described in Section 2.4.4, alternative methodologies will be pursued. Control limit criteria for the MS/MSD are found in Appendices A through E for each media.

3.6.2.2 Laboratory Control Standard (LCS) and Laboratory Control Standard Duplicates (LCSDs)

The laboratory control sample (LCS) is an aliquot of a solid or aqueous certified reference
material containing a known amount of each target analyte being measured. The LCS is treated like a field sample from the beginning of the procedure and is carried through the entire measurement process. The amount of the spike should be at a level less than or equal to the

midpoint of the calibration curve for each analyte. The LCS is analyzed once per batch of 20 analytical samples.

The percent recovery of the target analytes in the LCS assists in determining whether the procedure is in control. It is further used to evaluate the accuracy and bias of all or a portion of the measurement process. The LCS recovery is calculated as follows:

If insufficient quantity of sample is provided to perform a matrix spike and matrix spike duplicate, a duplicate LCS (LCSD) is prepared and analyzed and the RPD is calculated as described in Section 3.6.1.1.

Control limit criteria for the LCS are found in Appendices A through E for each media. If the LCS recovery is lower than the control limit or if the LCS recovery is higher than the control limit and the analyte is present in the samples, laboratory corrective should be taken. If the LCS recovery is higher than the control limit and the samples are ND for the analyte, the data may be accepted.

3.6.2.3 Detectability Check Sample

The laboratory should routinely check the instrument MDL to verify the laboratory's ability to reliably detect the parameter at the MDL that is used for reporting detected results and calculation of non-detected results. The detectability check standard will be checked on a quarterly basis and the results maintained on file with the MDL data.

3.6.2.4 Method Blank

The method blank is analyte-free water or solid material that is processed simultaneously with
and under the same conditions as the samples. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the Method Quantitation Limit or corrective action must be taken. No qualification is warranted if a sample result from the sample group is greater than or equal to five times the associated blank concentration. Analytical results less than five times the associated blank concentration

are qualified as non-detected.

3.6.2.5 Additional Method Specific QC Requirements

Additional QC samples may be run (e.g., continuing calibration samples), as specified in the method SOPs. The requirements for these samples, their acceptance criteria, and corrective action are method-specific.

3.6.3 Failures in Quality Control and Corrective Action

All qualified data are evaluated by the RI Manager, in consultation with the QA Manager. In that differences in field duplicate sample results are used to assess the entire sampling process, including environmental variability, the arbitrary rejection of results based on pre-determined limits is not practical. Therefore, the professional judgment of the RI Manager and QA Manager will be relied upon in evaluating results. Rejecting sample results based on wide variability is a possibility. Field blank values exceeding the acceptability criteria may automatically invalidate the sample, especially in cases where high blanks may be indicative of contamination that causes a result to exceed the standard. Field duplicate excursions will be noted. Equipment blank results are also scrutinized very closely. Corrective action will involve identification of the cause of the failure where possible. Response actions may include re-analysis of questionable samples. In some cases, a site may have to be resampled to achieve project goals.

Laboratory measurement quality control failures are evaluated by the Laboratory Project Manager and findings reported to the RI Manager. Specific instances requiring laboratory corrective action are listed in Section 4.1.3.

3.7 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the manufacturer's specifications for a particular piece of equipment. Sampling equipment is inspected and tested upon receipt and is verified to be appropriate for use. Field instruments and equipment will be maintained in accordance with the manufacturer's instructions. Field instruments that fail two consecutive calibration requirements will be tagged as "nonfunctional" and returned to the manufacturer for repair or replacement. Acceptance criteria are detailed in the manufacturer's documentation for each instrument.

The equipment testing and maintenance procedures for all laboratory tools, gauges and instruments are documented in the laboratory's QA Manual (Appendix G). Testing and maintenance records are maintained and are available for inspection. Instruments requiring daily or in-use testing may include, but are not limited to: water baths, ovens, autoclaves, incubators, refrigerators, and laboratory pure water. Critical spare parts for essential equipment are maintained or are available through a preferred vendor status to prevent downtime. Maintenance records are available for inspection.

3.8 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

3.8.1 Field Equipment Calibration

Field equipment calibration requirements are contained in the manufacturer's documentation. All field equipment requiring calibration will be conducted according to the manufacturer's specifications, including tolerance limits and frequencies. Calibration will be conducted daily prior to use. Pre- and post-calibration logs will be kept (or the information provided on standard field records) to insure that equipment has maintained calibration during its use.

3.8.2 Laboratory Equipment Calibration

Detailed laboratory calibration procedures are contained within the specifications and SOPs for each analysis in Appendix G. The laboratory QA Manager identifies all tools, gauges, instruments, and other sampling, measuring, and testing equipment used for data collection activities affecting quality that must be controlled and, at specified periods must be calibrated to maintain performance within specified limits. Calibration records are maintained and are available for inspection. Equipment requiring periodic calibrations include, but are not limited to, thermometers, pH meters, balances and analytical instruments.

3.9 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All new batches of field and laboratory supplies are inspected and tested before use to ensure that they are adequate and free of contaminants. Acceptance criteria are detailed in the manufacturer's documentation for the product. The Laboratory Project Manager provides additional details on acceptance requirements for laboratory supplies and consumables. The procurement of purchased items and services that directly affect the quality of environmental projects, shall be planned and controlled to ensure that the quality of the items and services is known, documented, and meets the QAPP requirements and acceptance criteria.

3.10 DATA MANAGEMENT

Data management provides a process for tracing the path of the data from their generation in the field or laboratory to their final use or storage. The following elements are included in this process: recording, validation, transformation, transmittal, reduction, analysis, tracking, and storage and retrieval.

3.10.1 Data Recording

Sample collection will be documented and tracked using field log forms, field logbook entries, and Chain-of-Custody Records. Field personnel will complete these forms, which then will be reviewed for correctness and completeness by the Field Supervisor. Copies of these forms will be maintained in the project files.

3.10.2 Data Validation

Data validation is addressed in Section 5.0 of this QAPP.

3.10.3 Data Transformation

Since data will be collected and/or reported using proper units according to this QAPP, no data transformation is expected. If data transformation is necessary, the transformation procedures will be added to this QAPP.

3.10.4 Data Transmittal

The Field Supervisor will be responsible for assuring that field data are entered onto the appropriate field data forms, and will report any problems to the RI Manager. Field Supervisors will submit the complete field data forms to the RI Manager for review and error checking.

Field Supervisors will also ensure that all samples collected in the field are submitted to the laboratory according to the methods outlined in this QAPP or the FSP. The laboratory will submit to the RI Manager or Field Supervisor the analytical data results in their standard hard-copy format (including raw data format) and in an electronic data deliverable (EDD) format prior to sending the final data report in PDF to the RI Manager. The EDD shall be in space or comma-delimitated ASCII format or in Excel spreadsheet format that will allow for easy integration into a digital database.

Once reviewed by the RI Manager or Field Supervisor for obvious transcription or reporting errors, the final data report in both hard-copy and EDD formats will be

transmitted and ready for validation by the QA Manager. Following data validation, any data qualifiers added to data during the validation process will be imported into the project database. Entry or upload of EDDs and data qualifiers into the project database will be completed by a designee of the RI Manager. The data and qualifiers will be initially verified by the individual entering the data. Upon completion of the initial verification step, a report will be generated of the data and verified by the RI Manager against the original data. Only final versions of electronic data will be entered into the database. All electronic data will be verified before and after incorporation into the database against the hard copy reports that accompany the data.

All qualified data will be included with the data packages during all subsequent data transmittal processes. The final hard copy data validation checklists will be included with the data in the Preliminary Site Characterization Report (PSCR).

All field forms and lab data will be organized and stored by sample location allowing for easy access if needed. Data can be transferred electronically either on disc, CD, tape or as an email attachment.

3.10.5 Data Analysis

Data analysis will be conducted as described in the RI/FS WP. Applications that may be utilized to analyze the data include Microsoft Excel and Microsoft Access. The results of data analysis for each activity will be presented in the Remedial Investigation Report.

3.10.6 Data Storage and Retrieval

PBW's RI Manager is responsible for project data storage and retrieval. Laboratory data that are stored electronically will be archived electronically, and where printed as part of the paper data report package, will also be archived in paper form. Both the electronic data and hard copies will be maintained in PBW's Round Rock, TX office. In general, all records and data must be retained for a period of 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS, per Section XX, Paragraph 79 of the UAO. Table 7 shows documents and record types, locations where these records will be housed, retention time and the form of the record.

4.0 ASSESSMENT AND OVERSIGHT ELEMENTS

4.1 ASSESSMENTS AND REPONSE ACTIONS

Table 8 presents types of assessments and response action for data collection activities governed by this QAPP.

4.1.1 Corrective Action

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or poor QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All proposed corrective actions should be documented as well as the steps taken to implement the corrective action. Corrective action should only be implemented after approval by the RI Manager or his designee. If immediate corrective action is required, approvals secured by telephone from the RI Manager should be documented.

For noncompliance problems, a formal corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the RI Manager. If the problem is related to an analytical procedure affecting the quality of data produced, this information will be promptly communicated to the Analytical Lab Project Manager, the RI Manager and the QA Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures will be identified and corrected in accordance with this QAPP. The RI Manager, or his designee, will issue a nonconformance report for each nonconformance condition and include a copy of this report in the project's files.

4.1.2 Field Corrective Action

Corrective action in the field may be needed when the sample program is changed (i.e., more/less samples, sampling locations or frequencies other than those specified in the RI/FS WP or FSP) or when sampling procedures and/or field procedures require modification due to unexpected conditions. In general, the field team may identify the need for corrective action. The field staff, in conjunction with the field team leader, will recommend a corrective action. The RI Manager will approve the corrective measure, which will be implemented by the field team. It will be the responsibility of the RI Manager to ensure the corrective action has been implemented.

If the corrective action will supplement the RI/FS WP or FSP, using existing and approved procedures in the QAPP, corrective action approved by the RI Manager will be documented. If corrective actions result in less samples, alternate sampling locations, etc., which may cause project QA objectives not to be achieved, it will be necessary that all levels of project management concur with the proposed action.

Corrective action resulting from internal field audits will be implemented immediately if data quality would be adversely affected due to unapproved or improper use of approved methods. The QA Manager will identify deficiencies and recommend corrective action to the RI Manager. Implementation of corrective actions will be performed by the field team under the direction of the RI Manager.

Corrective actions will be documented in the field book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If the actions taken are insufficient to correct the problem identified, work may be stopped by the RI Manager. If at any time a corrective action issue is identified which directly impacts the project objectives, the Project Coordinator will be notified immediately.

4.1.3 Laboratory Corrective Action

Corrective actions in the laboratory may occur prior to, during or after initial analyses. As such, the initial analyses must be performed quickly enough to allow time for reanalysis within the required holding time. A number of conditions, such as broken sample containers, may be identified during sample login or just prior to analysis. The Analytical Laboratory Project Manager will notify the QA Manager of such conditions prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for the Analytical Laboratory Project Manager to approve the implementation of corrective action. Some conditions that may trigger corrective action or optional procedures during or after analysis include dilution of samples, sample reanalysis when certain quality control criteria are not met, etc.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the control limits for precision or accuracy;
- Sample results are outside the instrument calibration range;
- Laboratory method blanks contain target analytes above acceptable levels;
- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

The following specific instances require laboratory corrective action:

- The laboratory method blanks contain target analytes above the MQL and any associated sample contains the analyte at a concentration less than five times that in the blank.
- The LCS recovery is less than 10% for any organic target analyte or 30% for any inorganic analyte.
- The LCS recovery is outside the control limit for more than 1/2 of the target analytes for multi-analyte analyses such as VOC and SVOC.
- The surrogate recovery is less than 10% for any single surrogate.

- The MS recovery is less than 30% for any inorganic analyte.
- The internal standard area is less than 25% of that in the midpoint standard for any single internal standard.

The corrective action shall include reanalyzing (and extracting or digesting, as applicable) the affected samples and/or immediate notification of the QA Manager.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the analytical procedures for possible errors, checks the instrument calibrations and performance, etc.

If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor or Analytical Laboratory Project Manager for further investigation. Once resolved, full documentation of the corrective action procedure is filed. These corrective actions are performed prior to release of the data from the laboratory. All corrective actions associated with sample analyses for this project will be documented and reported in the sample package Narrative.

1.1.4 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during either data validation or data assessment. Potential types of corrective action may include resampling, reanalysis of samples, or reprocessing of the sample data. These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required QA objectives. If the QA Manager identifies a corrective action situation, it is the RI Manager who will be responsible for approving the implementation of corrective action. All corrective actions of this type will be documented by the QA Manager.

4.2 REPORTS TO MANAGEMENT

4.2.1 Laboratory Data Report

Laboratory data reports contain the results of all specified QC measures listed in Section 2.5.4, including but not limited to equipment blank, filter and reagent blanks, field blanks, laboratory duplicates, laboratory control standards, calibration, and matrix spikes. This information is reviewed by the QA Manager and compared to the pre-specified acceptance criteria to determine acceptability of the data before forwarding to the RI Manager.

4.2.2 Reports to Project Management

The Field Supervisor will report to the RI Manager daily following each field monitoring event. A brief written report will be sent via e-mail to the RI Manager that documents any problems, delays, or corrective actions that may be required or that may affect the subsequent sampling efforts. The report will also include a brief synopsis of the work conducted during the field monitoring event.

5.0 DATA VALIDATION AND USABILITY

5.1 INTRODUCTION

Data are conventionally placed into one of five different levels (EPA, 1988), depending on the intended use of the data. These five analytical levels, the applicable data uses, and examples of the type of data are shown in the following table:

ANALYTICAL LEVEL	DATA USES	EXAMPLES
Level 1	Site Characterization Monitoring during implementation	Portable instruments Field test kits
Level 2	Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	Organics by gas chromatography (GC) Inorganics by atomic adsorption (AA) Inorganics by X-ray diffraction
Level 3	Risk Assessment PRP Determination Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	Analysis using analyte-specific EPA procedures, other than CLP
Level 4	Risk Assessment PRP Determination Evaluation of Alternatives Engineering Design	Organics/Inorganics by GC/MS, AA, ICP CLP analyses
Level 5	Risk Assessment PRP Determination	Non-conventional parameters Modified methods Appendix 8 Parameters

Standard data review levels, which have originated from the analytical levels, are defined as follows:

DATA REVIEW LEVEL	DATA USES	ITEMS VALIDATED	OBJECTIVE
Level 2	Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	General Performance Data such as Sample Preservation and Holding Time; Field and Laboratory Blanks; and Laboratory and Matrix Spikes	Assess technical validity
Level 3	Risk Assessment	General Performance Data plus	Assess technical validity

	PRP Determination Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	Instrument Performance Data such as Initial Calibration, Continuing Calibration Verification, and Interference Checks	Provide legal defensibility
Level 4	Risk Assessment PRP Determination Evaluation of Alternatives Engineering Design	General Performance Data, Instrument Performance Data, and Analyte Identification and Quantitation (raw data review)	Assess technical validity Provide legal defensibility Address data integrity

5.2 DATA REVIEW: VERIFICATION, VALIDATION, AND INTEGRITY

For the purpose of this document, verification means the processes taken to determine compliance of data with project requirements, including documentation and technical criteria. Validation means those processes taken independently of the data-generation processes to determine the usability of data for its intended use(s). Integrity means the processes taken to assure that no falsified data will be reported.

All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the project objectives that are listed in Section 2.4. Data supported by appropriate quality control results that meet the project objectives defined for this project will be considered acceptable without qualification. Data associated with quality control results that do not meet the project objectives defined for this project will be assigned appropriate qualifiers reflecting the potential impact on data usability. Analytical data will be considered usable unless rejected during the validation process.

The procedures for verification and validation of data are described in Section 5.3, below. The Field Supervisor is responsible for ensuring that field data are properly reviewed and verified for integrity by reviewing field equipment calibration records and verifying proper field procedures. The Analytical Lab Project Manager is responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and accuracy, and reviewed for integrity and indicates this by signing the data package Narrative. The QA Manager will be responsible for ensuring that all laboratory data are

properly reviewed and verified, and submitted in the required format to the project database. The QA Manager is responsible for validating the laboratory data and documenting the review. Finally, the RI Manager, with the concurrence of the QA Manager, is responsible for verifying that all data to be reported meet the objectives of the project and are suitable for reporting.

5.3 VERIFICATION AND VALIDATION METHODS

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the sample results and associated quality control data conform to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for the integrity, validation and verification of the data each task generates or handles throughout each process. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and information on COC forms and hard copy output from instruments. The Analytical Lab Project Manager will document the review of the reported data per the laboratory's QA Plan.

Verification, validation and integrity review of all laboratory data will be performed or supervised by the QA Manager. The data to be verified are evaluated against project specifications (Section 2.4) and are checked for errors, especially errors in transcription, calculations, and data input. The QA Manager will validate all reported laboratory data in accordance with the project Data Validation Standard Operating Procedure (SOP No. 17) (Appendix F). All laboratory data will be validated using a Level III data review. For critical samples, such as tissue analysis for human health risk assessment, a Level IV review may be instituted. The level of data review established for each media/activity is included in Appendices A-E. The validation will be documented on the Validation Checklist included in the SOP and data qualifiers will be added to the database as appropriate. The SOP includes guidelines for applying data qualifiers. Generally, data will be rejected for use if the holding time is grossly exceeded or the QC data indicates an extremely low bias (<10% true value) in the measurement.

Potential outliers are identified by the QA Manager and RI Manager by examining results for unreasonable data, or identified using computer-based statistical software. If a question arises or an error or potential outlier is identified, the Field Supervisor or the Analytical Lab Project Manager responsible for generating the data is contacted to resolve the issue. Issues that can be corrected are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the QA Manager and/or the RI Manager will determine the appropriate course of action, or the data associated with the issue are rejected.

The RI Manager and QA Manager are each responsible for validating that the verified data are scientifically valid, defensible, of known precision, accuracy, integrity, meet the project objectives of the project, and are reportable. One element of the validation process involves evaluating the data again for anomalies. The QA Manager or RI Manager may designate other experts familiar with the project to perform this evaluation. Any suspected errors or anomalous data must be addressed by the manager of the task associated with the data before data validation can be completed.

5.4 RECONCILIATION WITH USER REQUIREMENTS

The data collected pursuant to this QAPP will be evaluated to see whether it supports the project objectives (Table 6). Statistical evaluations may be performed on some data sets, as outlined in the RI/FS WP. The results of data evaluation, including limitations of the use of the data, will be presented in the RI Report.

6.0 REFERENCES

Pastor, Behling & Wheeler, LLC (PBW), 2005a. Site Health and Safety Plan, Gulfco Marine Maintenance Site, Freeport, Texas. August 17.

Pastor, Behling & Wheeler, LLC (PBW), 2005b. Draft RI/FS Work Plan, Gulfco Marine Maintenance Site, Freeport, Texas. October 6.

Pastor, Behling & Wheeler, LLC (PBW), 2005c. Draft Sampling and Analysis Plan – Volume I Field Sampling Plan, Gulfco Marine Maintenance Site, Freeport, Texas. October 6.

United States Environment Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition.

United States Environment Protection Agency (EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (Interim Report. (Final)). PB89-184626. October.

United States Environment Protection Agency (EPA), 1992. Guidance for Data Useability in Risk Assessment (Part A), Final.

United States Environment Protection Agency (EPA), 1994a. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94-013.

United States Environment Protection Agency (EPA), 1994b. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94-012.

United States Environment Protection Agency (EPA), 2000a. Guidance for the Data Quality Objectives Process, EPA QA/G-4. EPA/600/R-96/055. August.

United States Environment Protection Agency (EPA), 2000b. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1. OW/EPA 823-B-00-007. November.

United States Environment Protection Agency (EPA), 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. EPA/240/B-01/003. March.

United States Environment Protection Agency (EPA), 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5. EPA/240/R-02/009. December.